

# (12) UK Patent Application (19) GB (11) 2 355 281 (13) A

(43) Date of A Publication 18.04.2001

(21) Application No 9924205.9

(22) Date of Filing 14.10.1999

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(51) INT CL<sup>7</sup>

E05C 19/16 // A41F 1/00

(52) UK CL (Edition S )

E2A ACAH

(56) Documents Cited

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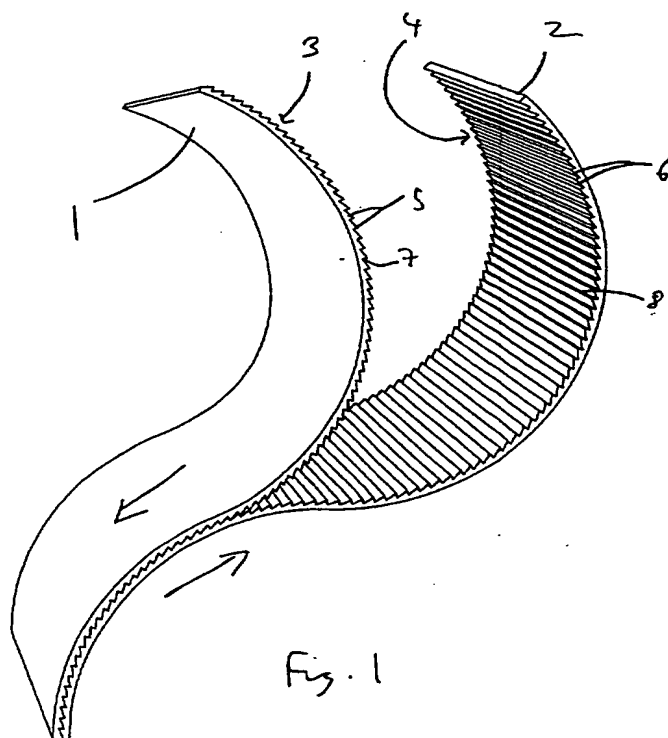
(58) Field of Search

UK CL (Edition R ) E2A ACAH  
INT CL<sup>7</sup> A41F 1/00 , E05C 19/16  
Online: EPODOC, WPI, PAJ

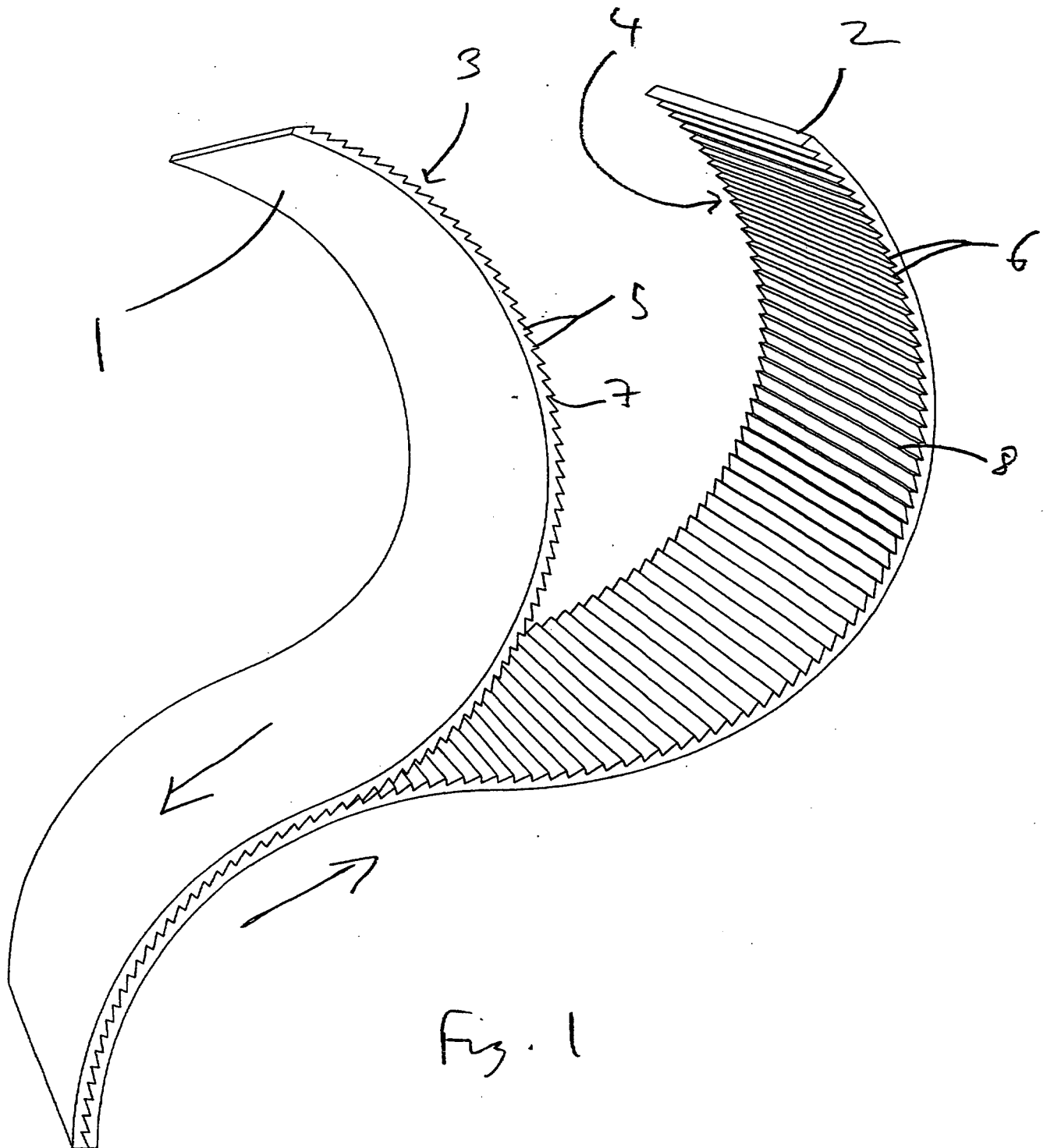
(54) Abstract Title

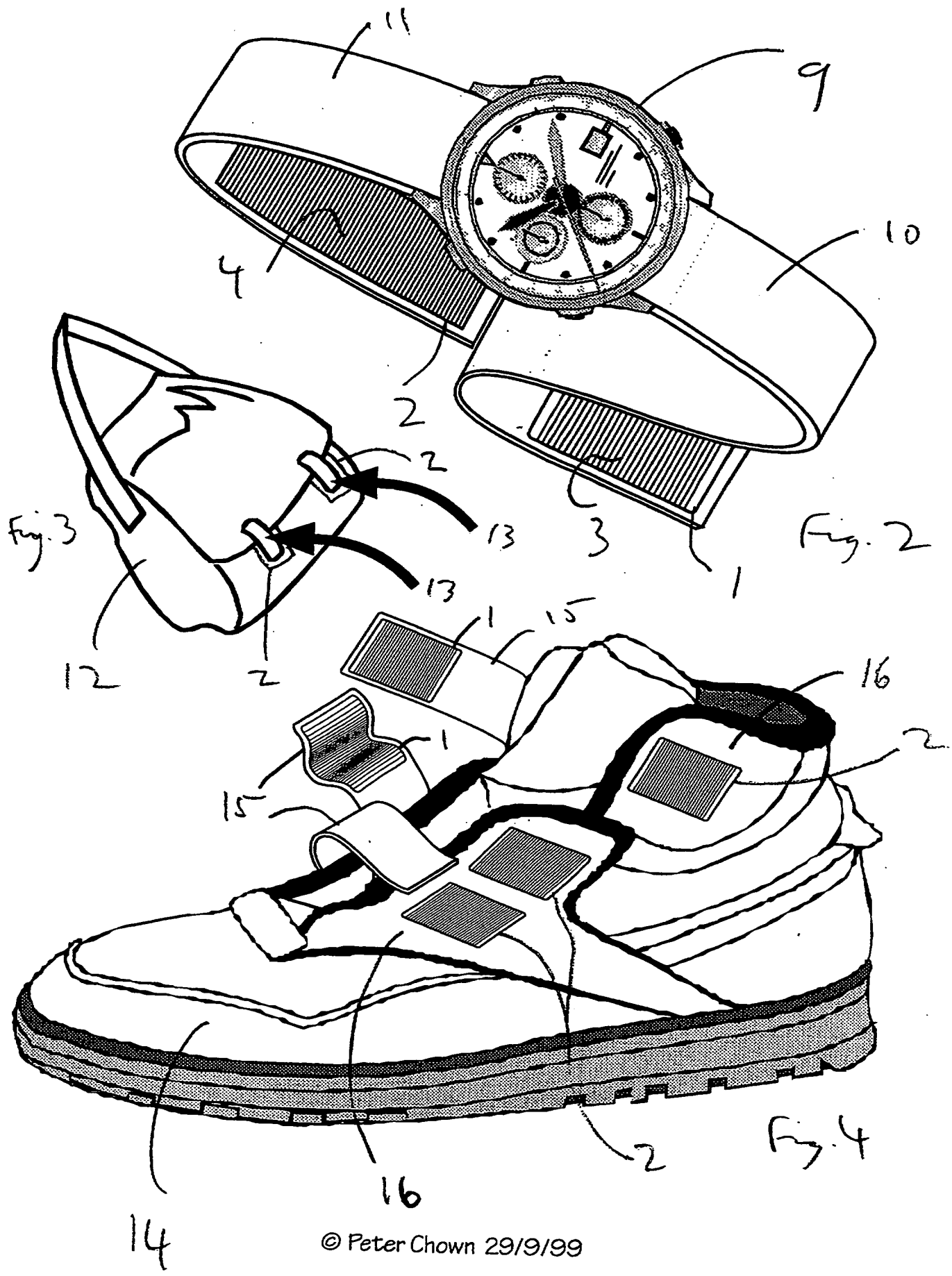
**Magnetic fastener**

(57) A magnetic fastener having first and second magnetic strips (1,2), each strip (1,2) having a facing surface (3,4) provided with saw-tooth serrations (5,6). The magnetic strips (1,2) are arranged so that the facing surface (3) of one strip (1) acts as a magnetic north pole and the facing surface (4) of the other strip (2) as a magnetic south pole. As a result, when the facing surfaces (3,4) of the strips (1,2) are brought together, they are held to each other by magnetic attraction. The saw-tooth serrations (5) of one strip (1) mutually engage with the saw-tooth serrations (6) of the other strip (2) so as to hinder relative lateral movement of the strips (1,2).



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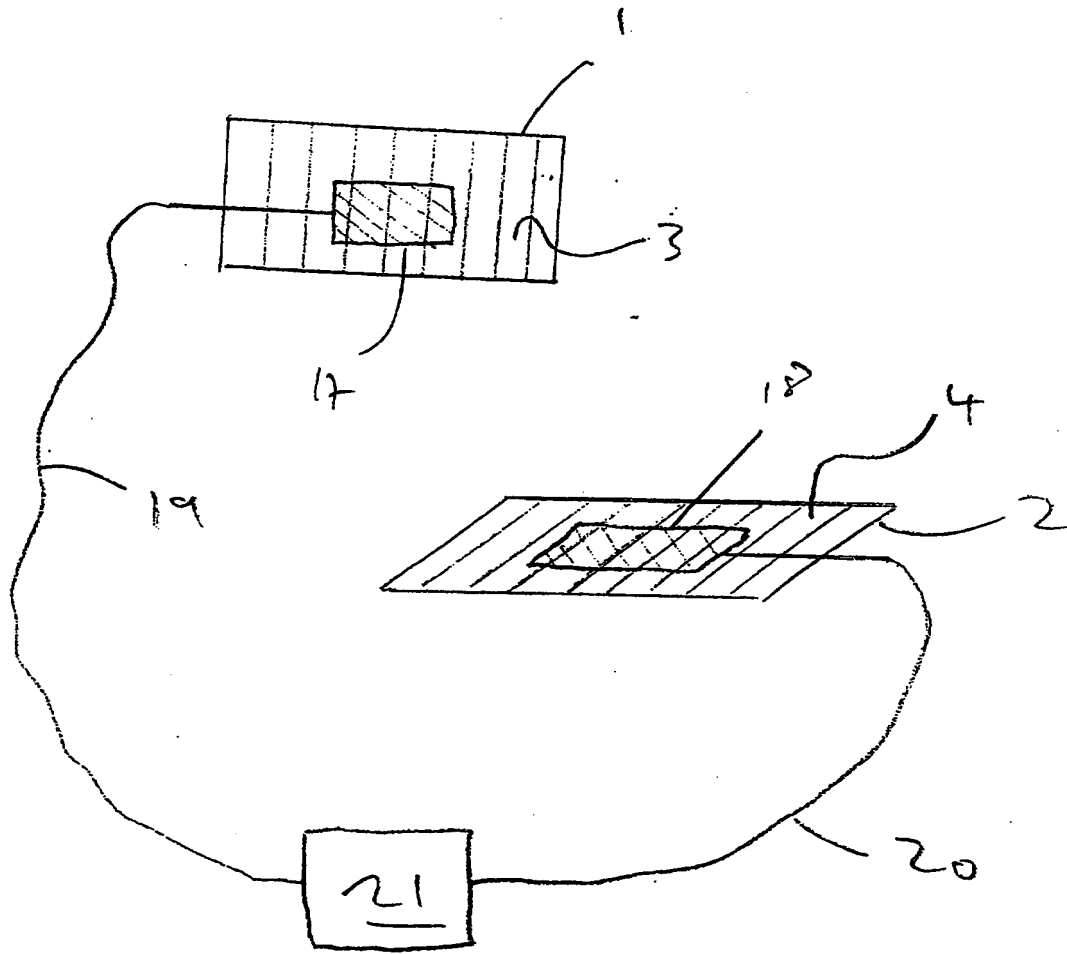


fig. 5

## MAGNETIC FASTENER

The present invention relates to a magnetic fastener, in particular but not exclusively designed to replace hook-and-loop type fasteners of the VELCRO® variety.

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Many items of clothing, such as shoes and jackets, and also items such as bags and watch straps, are provided with fasteners in the form of laces, poppers, buttons and the like. Although effective, these can be cumbersome to use, especially for children and the elderly.

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In order to address these concerns, fasteners of the hook-and-loop variety, such as VELCRO® fasteners, have been developed. These are simple to use and very effective in resisting lateral forces, but do wear out in time. Furthermore, both the hook component and the eye component tend to curl and become clogged with fluff and dirt, thereby reducing their effectiveness.

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According to the present invention, there is provided a fastening device having first and second parts each having a facing surface provided with a magnetic component arranged such that when the facing surfaces of the first and second parts are brought together, they are mutually magnetically attracted, and wherein the facing surfaces are provided with complementary projections and recesses adapted to mesh with each other and thereby to resist lateral movement of the facing surfaces when these are mutually magnetically attached.

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The first and second parts may each comprise a strip incorporating a flexible permanently magnetised magnetic compound, such as that used for flexible fridge magnets and the like. The magnetic compound is arranged so that one side of each strip is a north pole and the other a south pole, with the facing surface of one strip having an opposite polarity to the facing surface of the other strip. In this way, the facing surfaces of each part will tend to attract each other magnetically.

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In order to provide resistance against lateral forces when the facing surfaces of each part are brought together, the facing surfaces are provided with complementary projections and recesses. These may take the form of serrations, ridges or teeth separated by troughs, wherein the serrations, ridges or teeth of one facing surface mesh with the troughs of the other facing surface and *vice versa*.

In a particularly preferred embodiment, the serrations, ridges or teeth are shaped so as especially to resist mutual lateral movement of the facing surfaces in one direction but not the other. This may be achieved by shaping the serrations, ridges or teeth with a saw-tooth profile such that each presents a face which is perpendicular to or at an acute angle to the plane of the facing surface in the direction of the lateral movement which is to be resisted. The use of such a saw-tooth profile is particularly preferred, since the same profile may be used on both facing surfaces thus reducing manufacturing costs, and depending on the size and spacing of the saw-tooth profile, a large number of closely-spaced locking positions may be achieved.

Alternatively, complementary pegs and holes may be provided in the facing surfaces, the pegs and holes taking any mutually co-operating shape. By providing a number of sets of pegs and holes which are regularly spaced along the facing surface, a number of locking positions may be attained. Alternatively, there may be provided a single peg or set of pegs on one facing surface and a number of spaced holes or sets of holes on the other.

Alternatively or in addition, other mutually engaging locking mechanisms of any suitable form may be used. For example, one part of the fastening device may be fabricated from a ferrous metal provided with barbs, and the other part may comprise a relatively soft flexible magnetic compound in which the barbs may be retained.

The first and second parts of the present invention may be stitched or glued or otherwise attached to various substrates, such as straps or surfaces of articles of clothing and the like.

Unlike conventional VELCRO®-type fasteners, the facing surfaces of the first and second parts of the present invention do not attract fluff and dust, nor do they physically deteriorate with repeated usage. Furthermore, the fastening device of the present invention is particularly easy to use by all people and requires little dexterity  
5 to achieve a secure connection and easy release.

Where the fastening device of the present invention is used to provide a fastener for a bag or rucksack or the like, an additional security feature may be incorporated. This may comprise a reed switch or other magnetically operated switch provided on one or  
10 other or both of the first and second parts and connected to an alarm circuit. When the switch is activated by removal of one facing surface from the other, an alarm condition may be indicated by the alarm circuit in the form of an audible or visible signal or, particularly for use with a rucksack, a vibratory signal which can inform the wearer that the fastening is being tampered with. Alternatively, one or more  
15 electrical contacts may be provided on each of the facing surfaces, which contacts are connected to an alarm circuit and are arranged so as touch each other when the facing surfaces are mutually engaged, thus completing the alarm circuit. When the alarm circuit is broken by way of the facing surfaces being separated from each other, an alarm condition may be indicated as above. For particularly high security  
20 requirements, the alarm circuit may be provided with a transmitter so as remotely to indicate an alarm condition to a receiving unit. Examples where this might be useful include anti-tamper mechanisms for fire extinguishers or other articles disposed within a building or the like.

25 For a better understanding of the present invention and to show how it may be carried into effect, reference shall now be made by way of example to the accompanying drawings, in which:

FIGURE 1 shows a preferred embodiment of the present invention;

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FIGURE 2 shows an embodiment of the present invention applied to a watch strap;

FIGURE 3 shows an embodiment of the present invention applied to a bag;

FIGURE 4 shows an embodiment of the present invention applied to a shoe; and

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FIGURE 5 shows an embodiment of the present invention including an alarm circuit.

Referring firstly to Figure 1, there is shown first 1 and second 2 magnetic strips made of a flexible magnetic compound. The strips 1,2 each have a respective facing surface 3,4 which is provided with teeth 5,6 having a saw-tooth profile. The strips 1,2 are permanently magnetised in such a way that the facing surface 3 of the first strip 1 acts as a north pole and the facing surface 4 of the second strip 2 as a south pole. This means that the facing surfaces 3,4 experience a mutual magnetic attraction. The teeth 5,6 on each facing surface 3,4 are shaped so as to mesh with the teeth 6,5 on the other facing surface 4,3. In the embodiment shown, each tooth 5,6 has a face 7,8 which is substantially perpendicular to the notional plane of the strip 1,2. When the strips 1,2 are mutually engaged, the faces 7 of one set of teeth 5 abut the faces 8 of the other set of teeth 6 so that mutual lateral movement of the strips 1,2 in the directions indicated in the drawing is prevented, while mutual lateral movement in the opposite directions is permitted. This arrangement allows the strips 1,2 to be slid relative to each other in one direction, for example to effect tightening of a watch strap or belt (not shown) while preventing mutual sliding in the other direction, thereby holding the watch strap or belt tightly secured around the wrist or waist of a wearer.

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Figure 2 shows a watch 9 having two strap portions 10,11. Each strap portion 10,11 is provided with a strip 1,2 as described above, the strips 1,2 being attached by stitching or adhesive to the strap portions 10,11 in such a way that the facing surfaces 3,4 abut each other when the strap portions 10,11 are placed around the wrist of a wearer.

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Figure 3 shows a bag 12 having two securing straps 13. On the underside of each strap 13 is provided a strip 1, and attached to a corresponding position on the bag 12 is a strip 2.

- 5 Figure 4 shows a training shoe 14 provided with securing straps 15. Each securing strap 15 has attached thereto a strip 1, and corresponding strips 2 are provided on upper portions 16 of the shoe 14. To secure the shoe 14 tightly around the foot of a wearer, the straps 15 are pulled across and secured to the upper portions 16 by way of the strips 1,2.

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- Referring now to Figure 5, there is shown a pair of complementary strips 1,2 each provided with an electrically conductive region 17,18 on their facing surfaces 3,4. The electrically conductive regions 17,18 may comprise a metal film or laminate, and are arranged so as to contact each other when the facing surfaces 3,4 of the strips 1,2 are mutually engaged. Each electrically conductive region 17,18 is connected by a cable 19,20 to an alarm unit 21. The alarm unit 21 contains electronic circuitry (not shown) adapted to issue an audible, visible or other alarm signal when the facing surfaces 3,4 become disengaged due to separation of the strips 1,2. An alarm override mechanism (not shown) may be provided so as to allow an authorised user to separate the strips 1,2 without triggering the alarm signal. The override mechanism may be activated by entering a code number into the alarm unit 21 or by pressing a hidden override switch (not shown), the position of which is known only to the authorised user.
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**CLAIMS:**

1. A fastening device having first and second parts each having a facing surface provided with a magnetic component arranged such that when the facing surfaces of the first and second parts are brought together, they are mutually magnetically attracted, and wherein the facing surfaces are provided with complementary projections and recesses adapted to mesh with each other and thereby to resist lateral movement of the facing surfaces when these are mutually magnetically attached.
2. A device as claimed in claim 1, wherein at least one of the magnetic components comprises a flexible magnetic compound.
3. A device as claimed in claim 1 or 2, wherein the projections and recesses comprise a set of regularly spaced serrations, ridges or teeth separated by troughs.
4. A device as claimed in claim 3, wherein the serrations, ridges or teeth have a saw-tooth profile.
5. A device as claimed in claim 4, wherein each of the serrations, ridges or teeth presents a face which is perpendicular to or at an acute angle to the notional plane of the facing surface on which it is situated.
6. A device as claimed in claim 1 or 2, wherein the projections and recesses comprise pegs and holes taking any mutually co-operating shape.
7. A device as claimed in claim 1 or 2, wherein one of the magnetic components comprises an element of magnetised ferrous metal provided with a number of barbs, and the other comprises a flexible magnetic compound in which the barbs may be retained.

8. A device as claimed in any preceding claim, wherein an electrical switch is provided in one or other or both of the first and second parts, the switch being adapted to be operated upon mutual engagement and disengagement of the facing surfaces.
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9. A device as claimed in claim 8, wherein the electrical switch comprises a reed switch or other magnetically operated switch.
10. A device as claimed in claim 8, wherein the electrical switch comprises a  
10 conductive element provided on each facing surface and positioned so as to contact each other upon mutual engagement of the facing surfaces.
11. A device as claimed in claim 8, 9 or 10, wherein there is further provided an alarm unit electrically connected to the electrical switch, which alarm unit is adapted  
15 to generate an alarm signal upon disengagement of the facing surfaces.
12. A device as claimed in claim 11, wherein the alarm unit is provided with an override switch operable by an authorised user so as to disable the alarm signal.
- 20 13. A device as claimed in claim 11 or 12, wherein the alarm unit is adapted to transmit an alarm signal to a remote location by way of electromagnetic radiation.
14. A fastening device substantially as hereinbefore described with reference to the accompanying drawings.

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Application No: GB 9924205.9  
Claims searched: 1-13

Examiner: Philip Silvie  
Date of search: 8 February 2000

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.R): E2A (ACAH)  
Int Cl (Ed.7): A41F 1/00; E05C 19/16  
Other: Online: EPODOC, WPI, PAJ

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	GB 0 875 807 A (BAERMANN) see figs. 8,9	1,2,6 at least
X	US 4 249 267 A (VOSS) see fig. 7	1-3 at least
X	US 4 197 618 A (BOURGUIGNON) see fig. 3	1,3-6 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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